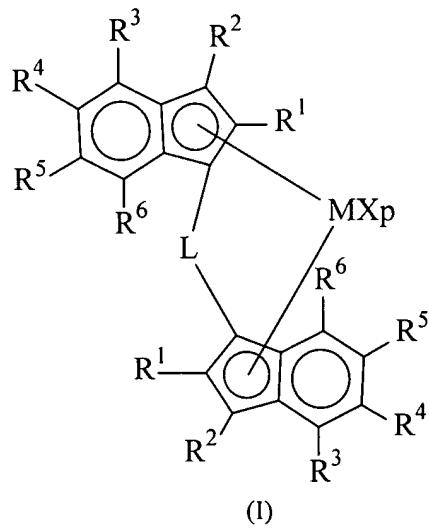


AMENDMENTS TO THE CLAIMS

1. (currently amended) A process for preparing 1-butene polymers optionally containing up to 30% by mol of derived units of ethylene, propylene or an alpha olefin of formula $\text{CH}_2=\text{CHZ}$, wherein Z is a $\text{C}_3\text{-}\text{C}_{10}$ alkyl group, comprising polymerizing 1-butene and optionally ethylene, propylene or said alpha olefin, in the presence of a catalyst system obtainable obtained by contacting:

- a) at least a metallocene compound of formula (I):



wherein:

M is an atom of a transition metal selected from those belonging to group 3, 4, 5, 6 or to the lanthanide or actinide groups in the Periodic Table of the Elements;

p is an integer from 0 to 3, being equal to the formal oxidation state of the metal M minus 2;

X, equal to or different from each other, are hydrogen atoms, halogen atoms, or R, OR, OSO_2CF_3 , OCOR, SR, NR₂ or PR₂ groups, wherein R is a linear or branched, saturated or unsaturated $\text{C}_1\text{-}\text{C}_{20}$ alkyl, $\text{C}_3\text{-}\text{C}_{20}$ cycloalkyl, $\text{C}_6\text{-}\text{C}_{20}$ aryl, $\text{C}_7\text{-}\text{C}_{20}$ alkylaryl or $\text{C}_7\text{-}\text{C}_{20}$ arylalkyl radical, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two X can optionally form a substituted or unsubstituted butadienyl radical or a OR'O group wherein R' is a divalent radical selected from $\text{C}_1\text{-}\text{C}_{20}$ alkylidene, $\text{C}_6\text{-}\text{C}_{40}$ arylidene, $\text{C}_7\text{-}\text{C}_{40}$ alkylarylidene and $\text{C}_7\text{-}\text{C}_{40}$ arylalkylidene radicals;

R^1 , equal to or different from each other, are linear or branched, saturated or unsaturated C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_6 - C_{20} -aryl, C_7 - C_{20} -alkylaryl or C_7 - C_{20} -arylalkyl radicals, optionally containing one or more heteroatoms at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

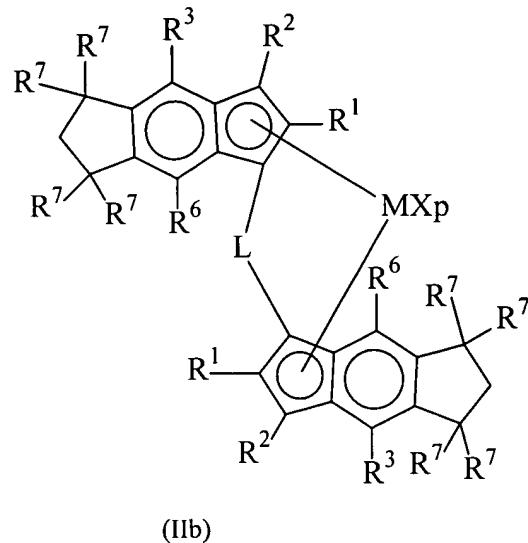
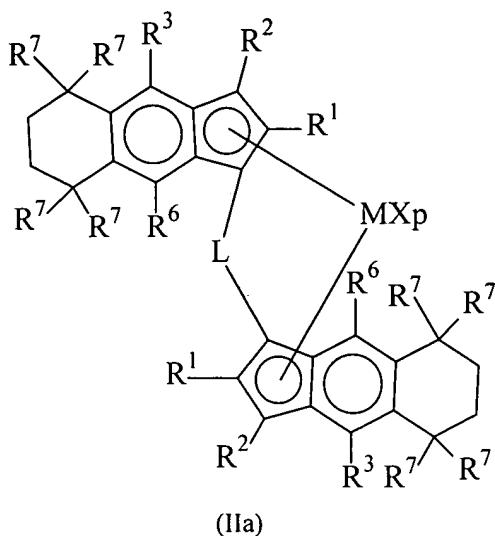
R^2 , R^3 and R^6 , equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_6 - C_{20} -aryl, C_7 - C_{20} -alkylaryl or C_7 - C_{20} -arylalkyl radicals, optionally containing one or more heteroatoms at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

R^4 and R^5 , form together a condensed saturated or unsaturated C_3 - C_7 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements; every atom forming said ring being substituted with R^7 radicals wherein R^7 , equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_6 - C_{20} -aryl, C_7 - C_{20} -alkylaryl or C_7 - C_{20} -arylalkyl radicals, optionally containing one or more heteroatoms at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

L is a divalent bridging group selected from C_1 - C_{20} alkylidene, C_3 - C_{20} cycloalkylidene, C_6 - C_{20} arylidene, C_7 - C_{20} alkylarylidene, or a C_7 - C_{20} arylalkylidene radical optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, or a silylidene radical containing up to 5 silicon atoms; and

- b) an alumoxane or a compound ~~able to form~~ ~~that forms~~ an alkylmetallocene cation.
- 2. (original) The process according to claim 1 wherein the catalyst system further comprises an organo aluminum compound.
- 3. (currently amended) The process according to claim 1-~~or 2~~, wherein in the compound of formula (I), M is titanium, zirconium or hafnium; X is a hydrogen atom, a halogen atom or a R group ~~wherein R has the same meaning as in claim 1 and~~ L is $Si(R^8)_2$, wherein R^8 is a linear or branched, saturated or unsaturated C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_6 - C_{20} -aryl, C_7 - C_{20} -alkylaryl or C_7 - C_{20} -arylalkyl radical.
- 4. (currently amended) The process according to ~~anyone of claims 1 to 3~~ claim 1 wherein R^1 is a C_1 - C_{20} -alkyl radical; R^2 , R^3 and R^6 are hydrogen atoms and R^7 is a hydrogen atom or a linear or branched, saturated or unsaturated C_1 - C_{20} -alkyl radical.

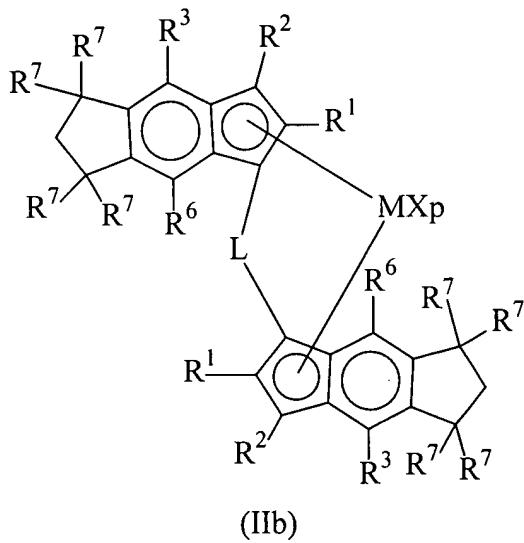
5. (currently amended) The process according to ~~anyone of claims 1 to 4~~claim 1 wherein the compound of formula (I) has formula (IIa) or (IIb):



wherein:

~~M, X, p, L, R¹, R², R³, R⁶ and R⁷ have the same meaning as in claim 1.~~

6. (currently amended) The process according to ~~anyone of claims 1 to 5~~claim 1 wherein 1-butene is homopolymerized.
7. (currently amended) A metallocene compound of formula (IIb):



wherein M, p, L, R¹, R², R³, R⁶, R⁷ and X have the same meaning as in claim 1

M is an atom of a transition metal selected from those belonging to group 3, 4, 5, 6 or to the lanthanide or actinide groups in the Periodic Table of the Elements;

p is an integer from 0 to 3, being equal to the formal oxidation state of the metal M minus

2:

L is a divalent bridging group selected from C₁-C₂₀ alkylidene, C₃-C₂₀ cycloalkylidene, C₆-C₂₀ arylidene, C₇-C₂₀ alkylarylidene, or a C₇-C₂₀ arylalkylidene radical optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, or a silylidene radical containing up to 5 silicon atoms;

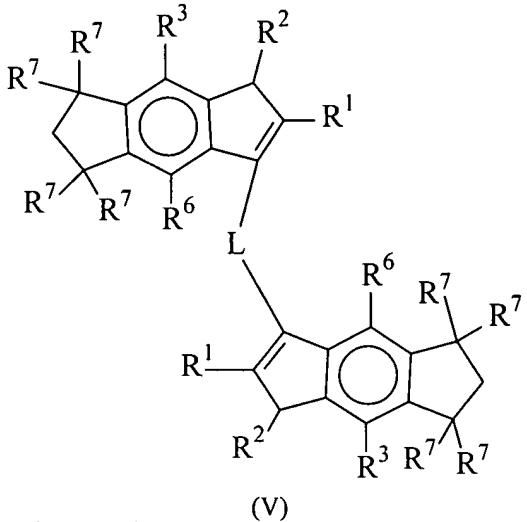
R¹, equal to or different from each other, are linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

R², R³ and R⁶, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

R⁷, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

X, equal to or different from each other, are hydrogen atoms, halogen atoms, or R, OR, OSO₂CF₃, OCOR, SR, NR₂ or PR₂ groups, wherein R is a linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radical, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two X can optionally form a substituted or unsubstituted butadienyl radical or a OR'O group wherein R' is a divalent radical selected from C₁-C₂₀ alkylidene, C₆-C₄₀ arylidene, C₇-C₄₀ alkylarylidene and C₇-C₄₀ arylalkylidene radicals.

8. (currently amended) A ligand of formula (V) or its corresponding double bond isomer:



~~wherein L, R¹, R², R³, R⁶, and R⁷ have the same the same meaning as in claim 1~~

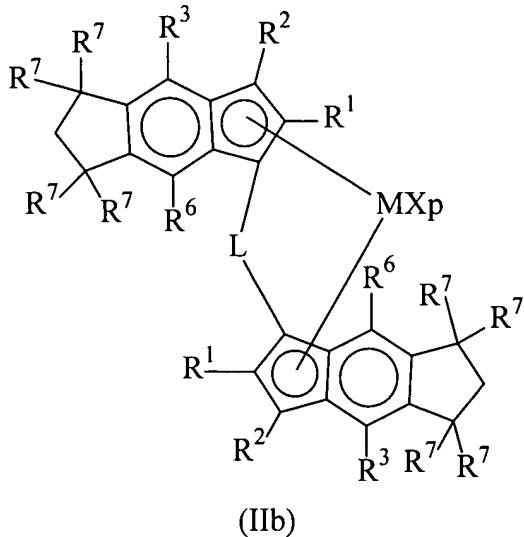
L is a divalent bridging group selected from C₁-C₂₀ alkylidene, C₃-C₂₀ cycloalkylidene, C₆-C₂₀ arylidene, C₇-C₂₀ alkylarylidene, or a C₇-C₂₀ arylalkylidene radical optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, or a silylidene radical containing up to 5 silicon atoms;

R¹, equal to or different from each other, are linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

R², R³ and R⁶, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; and

R⁷, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements.

9. (currently amended) A process for preparing ~~the~~ metallocene compound of formula (IIb):



~~wherein M, p, L, R¹, R², R³, R⁶, R⁷ and X have the same meaning as in claim 1~~

M is an atom of a transition metal selected from those belonging to group 3, 4, 5, 6 or to the lanthanide or actinide groups in the Periodic Table of the Elements;

p is an integer from 0 to 3, being equal to the formal oxidation state of the metal M minus 2;

L is a divalent bridging group selected from C₁-C₂₀ alkylidene, C₃-C₂₀ cycloalkylidene, C₆-C₂₀ arylidene, C₇-C₂₀ alkylarylidene, or a C₇-C₂₀ arylalkylidene radical optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, or a silylidene radical containing up to 5 silicon atoms;

R¹, equal to or different from each other, are linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

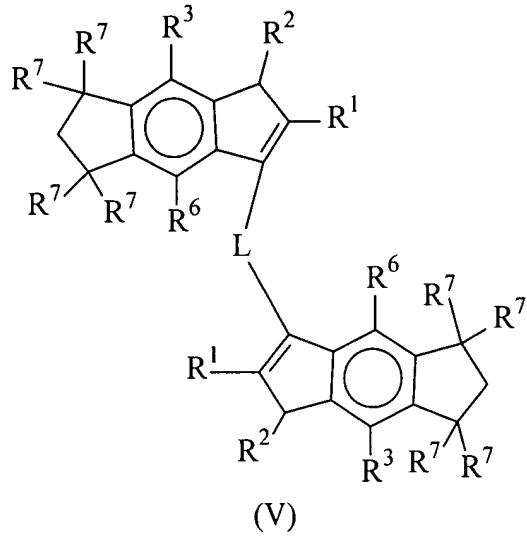
R², R³ and R⁶, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R⁷, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

X, equal to or different from each other, are hydrogen atoms, halogen atoms, or R, OR, OSO₂CF₃, OCOR, SR, NR₂ or PR₂ groups, wherein R is a linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radical, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two X can optionally form a substituted or unsubstituted butadienyl radical or a OR' O group wherein R' is a divalent radical selected from C₁-C₂₀ alkylidene, C₆-C₄₀ arylidene, C₇-C₄₀ alkylarylidene and C₇-C₄₀ arylalkylidene radicals;

comprising the following steps:

a) contacting a ligand of formula (V)



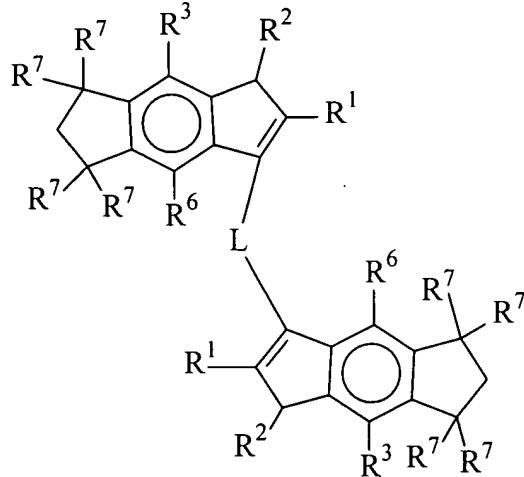
or its double bond isomer

wherein R¹, R², R³, R⁶, R⁷ and L have the same meaning as in claim 1-with a base of formula T_jB or TMgT¹, or sodium or potassium hydride, or metallic sodium or potassium; wherein B is an alkaline or alkali-earth metal and j is 1 or 2, j being equal to 1 when B is an alkaline metal, and j being equal to 2 when B is an alkali-earth metal; T is selected from the group consisting of linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl groups, optionally containing one or more at least one Si or Ge atom; T¹ is a halogen atom or a group OR" wherein R" is a linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing one or more heteroatoms at least one heteroatom

belonging to groups 13-17 of the Periodic Table of the Elements; wherein the molar ratio between said base and the ligand of the formula (V) and is at least 2:1; and

- b) contacting the product obtained in step a) with a compound of formula MX_4
~~wherein M and X have the same meaning as in claim 1.~~

10. (currently amended) A process for preparing ~~the~~ ligand of formula (V)



(V)

or its double bond isomer

~~wherein R¹, R², R³, R⁶, R⁷ and L have the same meaning as in claim 1,~~

L is a divalent bridging group selected from C₁-C₂₀ alkylidene, C₃-C₂₀ cycloalkylidene, C₆-C₂₀ arylidene, C₇-C₂₀ alkylarylidene, or a C₇-C₂₀ arylalkylidene radical optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, or a silylidene radical containing up to 5 silicon atoms;

R¹, equal to or different from each other, are linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

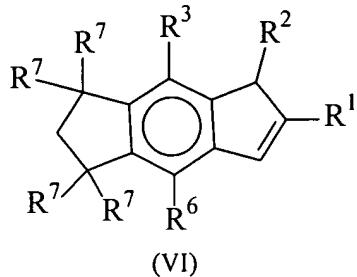
R², R³ and R⁶, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R⁷, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or

C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

comprising the following steps:

- a) contacting a compound of formula (VI):

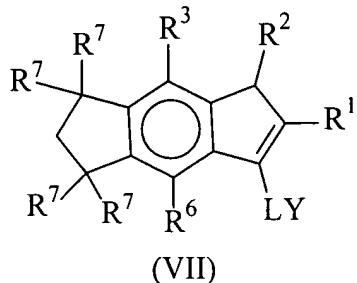


or its double bonds isomer

~~wherein: R¹, R², R³, R⁶, and R⁷ have the same the same meaning as in claim 1;~~

with a base of formula T_jB or TMgT¹, or sodium or potassium hydride, or metallic sodium or potassium; wherein B is an alkaline or alkali-earth metal and j is 1 or 2, j being equal to 1 when B is an alkaline metal, and j being equal to 2 when B is an alkali-earth metal; T is selected from the group consisting of linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl groups, optionally containing one or more Si or Ge atoms; T¹ is a halogen atom or a group OR" wherein R" is a linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing one or more heteroatoms at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements; wherein the molar ratio of said base and the compound of the formula (VI) is at least 1:1;

- b) contacting ~~the obtained~~ anionic compounds obtained in step a) with a compound of formula (VII):

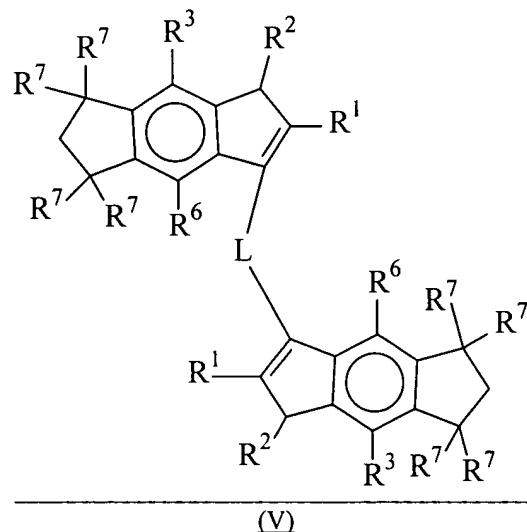


or its double bonds isomer

wherein R^1, R^2, R^3, R^6, R^7 and L have the same meaning as in claim 1 and

Y is a halogen radical selected from the group consisting of chloride, bromide and iodide.

11. (currently amended) A process for preparing the ligand of formula (V): when



or its double bond isomer

wherein

L is a divalent bridging group selected from C_1-C_{20} alkylidene, C_3-C_{20} cycloalkylidene, C_6-C_{20} arylidene, C_7-C_{20} alkylarylidene, or a C_7-C_{20} arylalkylidene radical optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, or a silylidene radical containing up to 5 silicon atoms;

R^1 , equal to or different from each other, are linear or branched, saturated or unsaturated C_1-C_{20} -alkyl, C_3-C_{20} -cycloalkyl, C_6-C_{20} -aryl, C_7-C_{20} -alkylaryl or C_7-C_{20} -arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements;

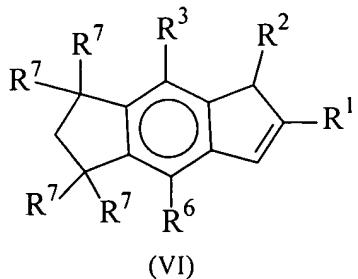
R^2, R^3 and R^6 , equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C_1-C_{20} -alkyl, C_3-C_{20} -cycloalkyl, C_6-C_{20} -aryl, C_7-C_{20} -alkylaryl or C_7-C_{20} -arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^7 , equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C_1-C_{20} -alkyl, C_3-C_{20} -cycloalkyl, C_6-C_{20} -aryl, C_7-C_{20} -alkylaryl or

C₇-C₂₀-arylalkyl radicals, optionally containing at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements:

wherein the substituents R¹, R², R³, R⁶ and R⁷ are the same in both the indenyl moieties, comprising the following steps:

- a) contacting a compound of formula (VI):



or its double bonds isomer

wherein: R¹, R², R³, R⁶ and R⁷ have the same the same meaning as in claim 1; with a base of formula T_jB or TMgT¹, or sodium or potassium hydride, or metallic sodium or potassium; wherein B is an alkaline or alkali-earth metal and j is 1 or 2, j being equal to 1 when B is an alkaline metal, and j being equal to 2 when B is an alkali-earth metal; T is selected from the group consisting of linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl groups, optionally containing one or more at least one Si or Ge atoms; T¹ is a halogen atom or a group OR" wherein R" is a linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl or C₇-C₂₀-arylalkyl radicals, optionally containing one or more heteroatoms at least one heteroatom belonging to groups 13-17 of the Periodic Table of the Elements; wherein the molar ratio between said base and the compound of the formula (VI) is at least 1:1;

- b) reacting ~~the~~ product obtained in step a) with a compound of formula YLY, wherein L and Y have the same the same meaning as in claim 9 is a halogen radical selected from the group consisting of chloride, bromide and iodide and wherein the molar ratio between the compound obtained in step a) and the compound of formula YLY is at least 2:1.